

HW1: Analyzing Free Energy

Name: _____

Date: _____ Per: _____

For a reaction to be spontaneous, the sign of ΔG (Gibb's Free Energy) must be negative. The mathematical formula for this value is:

$$\Delta G = \Delta H - T\Delta S$$

Where...

ΔH = change in enthalpy or heat of reaction
 T = temperature in Kelvin
 ΔS = change in entropy or randomness

Directions: Complete the table for the sign of ΔG : +, -, or undetermined. When conditions allow for an undetermined sign of ΔG , temperature will decide spontaneity. Then answer the questions that follow.

ΔH	ΔS	ΔG
-	+	
+	-	
-	-	
+	+	

1. The conditions in which ΔG is always negative is when ΔH is _____ and ΔS is _____
2. The condition in which ΔG is always positive is when ΔH is _____ and ΔS is _____
3. Explain what must be true of temperature in each of the indeterminate conditions.

For questions 4-6 choose either "always" "sometimes" or "never" to complete the statement.

4. The reaction: $\text{NaOH (s)} \rightarrow \text{Na}^+(\text{aq}) + \text{OH}^-(\text{aq}) + \text{energy}$, will _____ be spontaneous.
5. The reaction: $\text{energy} + 2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{H}_2\text{O}(\text{l})$ will _____ be spontaneous.
6. The reaction: $\text{energy} + \text{H}_2\text{O}(\text{s}) \rightarrow \text{H}_2\text{O}(\text{l})$ will _____ be spontaneous.
7. What is the value of ΔG for a reaction where the enthalpy change is -32.0kJ, the entropy change is 25.0kJ/K and the temperature is 293K.
8. Is the reaction in question #7 spontaneous?
9. What is the value of ΔG in a reaction where 12.0kJ of energy are absorbed, entropy decreases by 5kJ/K and the temperature is 290K?
10. Is the reaction in question #9 spontaneous?